REMARKS

Claims 1-5 are present in this application. Claims 1 and 5 are independent claims. Claim 5 has been added.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

§§ 102(b)/103(a) Rejection – Yamada

Claims 1-4 have been rejected under 35 U.S.C. §102(b) as being anticipated by, or in the alternative under 35 U.S.C. §103(a) as obvious over, U.S. Patent 6,001,203 (Yamada). Applicant respectfully traverses this rejection.

Summary of the Present Invention

The present invention is an improved manufacturing process for liquid crystal display devices. In particular, Applicant has determined that known techniques for manufacturing liquid crystal display devices can produce uneven cell thickness and a phenomenon termed "vacuum bubble." Known techniques involve a step of applying a sealant on one of two substrates, and simultaneously dropping a liquid crystal on one of the substrates and bonding the two substrates together in a vacuum state (see specification at page 2, second full paragraph).

Applicant has determined that a solution to the problems of uneven cell thickness and "vacuum bubble," can be solved by allowing the liquid crystal to spread to contact along substantially a whole periphery of the sealant before setting the sealant (see specification at page 7, bottom paragraph). For example, in disclosed embodiment, the step of setting the sealant was started after a lapse of 90 seconds after bonding of the substrates (see specification at page 9, lines 12-14).

Yamada

Yamada discloses a production process for a liquid crystal display panel, and in particular, various seal materials for the liquid crystal cell. Yamada has an objective of producing a liquid crystal display panel having a uniform cell gap between two substrates without dislocation of alignment between the substrates.

Yamada discloses an example of achieving uniform cell gap where the structure of the liquid crystal display panel is formed by controlling a cell gap by sprinkling glass beads spacer material 2 between two substrates (col. 12, Example 2).

Yamada discloses an example of forming the liquid crystal display panel by a dropping method (Example 5). The dropping method involves forming a seal material on one of two substrates, attaching the substrates via a spacer and dropping a liquid crystal therebetween. In the disclosed example, a liquid crystal 13 was dropped with a liquid dispenser 14 to a region surrounded by seal material. Glass beads as spacer material 2 was uniformly sprinkled and fixed to the inner side of the substrate having electrodes opposing the substrate on which the liquid crystal was placed. Then the two substrates are attached to each other in a reduced pressure in a vacuum chamber. By further applying compression to the substrate by atmospheric pressure, the gap is controlled. (col. 19, lines 10-23).

Differences over Yamada

The Office Action indicates that Yamada's step of attaching two substrates under compression teaches the claimed spreading the liquid crystal along substantially a whole periphery of the sealant. The Office Action refers to two sections in Yamada regarding these steps (Fig. 5; col. 4, ls. 24-27 and col. 5, ls. 13-25).

Fig. 5 of Yamada shows an example end product. The section at col. 4 indicates that it is preferable to form the liquid crystal display panel by dropping liquid crystal between the step of forming a seal and a step of attaching the two substrates. The section at col. 5 indicates that the seal forming process involves forming a seal portion at the edge portion of one of the substrates

by a seal comprising ultraviolet ray curing agent component and a thermosetting agent component. The curing step provides at least 50 percent of the curing ratio by irradiating an ultraviolet ray to the sealing resin and a second step of increasing curing to at least 80 percent of the curing ratio of the curing by heating. In other words, the section at col. 5 indicates that the sealing forming step involves partial curing of the resin.

To the contrary, claim 1 requires setting sealant after the spreading step. The Applicant discloses reasons why conventional processes such as that in Yamada do not actually achieve a uniform cell gap. For example, the Applicant found that during bonding of the upper and lower substrates each side of the sealant spreads equal when the inner side surface of the sealant is not in contact with the liquid crystal. The liquid crystal spreads as well during the bonding period. When the inner side surface of the sealant contacts the liquid crystal, the sealant and the liquid crystal press each other in that portion. Consequently, the speed of spreading of the sealant is decreased in that portion. In a portion in which the inner side surface of the sealant has still not come in contact with the liquid crystal, the thickness in that portion is smaller. Then, when setting of the sealant is started before the liquid crystal contacts the whole periphery of the inner side surface of the sealant, the sealant in the portion having inner side surface contacting the liquid crystal is set with a relatively large thickness. Thus, the cell thickness is uneven. As a result, the liquid crystal becomes insufficient and a vacuum bubble may be generated. (specification at page 6 and 7).

Applicant found that problems with conventional dropping method can be solved when, in the step of setting, including the step of bonding, the sealant is set after the liquid crystal sandwiched between the two substrates is spread to contact the sealant along substantially a whole periphery of the sealant while both substrates contact the sealant along the whole periphery of the sealant. (specification at bottom paragraph of page 7).

In order to clarify this feature, claim 1 has been amended to include a delay period of time before the setting step begins. Applicant submits that Yamada fails to teach or suggest at least the claimed "said step of bonding includes the step of setting said sealant, wherein said setting step is delayed a period of time until after said liquid crystal sandwiched between said

two substrates is spread to contact said sealant along substantially a whole periphery of said sealant while both of said two substrates contact said sealant along the whole periphery of said sealant."

Accordingly, Applicant requests that the rejection be reconsidered and withdrawn.

New Claim

Claim 5 has been added. Claim 5 explicitly recites a sequence of steps involved in the present manufacturing process. Applicant submits that at least for the reasons above for claim 1, claim 5 is patentable as well.

Conclusion

In view of the above remarks, it is believed that claims are allowable.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact **Robert Downs** Reg. No. 48,222 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

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